IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPELLANT:	RICHARD C. CHU ET AL	) Group Art Unit:
SERIAL NUMBER:	09/965,489	) 3745
FILED:	September 27, 2001	) Examiner: Lam
FOR:	THERMAL SPREADER USING THERMAL CONDUITS	)

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APPEAL BRIEF

1. REAL PARTY IN INTEREST

The real party in interest in this Appeal is the Assignee, International Business Machines Corporation.

2. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences known at this time to the Appellants, or the Appellants' legal representatives which will directly affect, or be directly affected by, or have a bearing upon the Board's decision in this appeal.

3. STATUS OF THE CLAIMS

Claims 1-14 are pending in the application.

The outstanding Final Office Action rejects claims 1-6 as being anticipated under 35 U.S.C. § 102(b), or in the alternative as obvious under 35 U.S.C. § 103(a), over Gungor.

The outstanding Final Office Action rejects claims 7-14 as being unpatentable under 35 U.S.C. § 103(a), over Gungor in view of Eckblad.

The rejection of claims 1-14 is appealed.

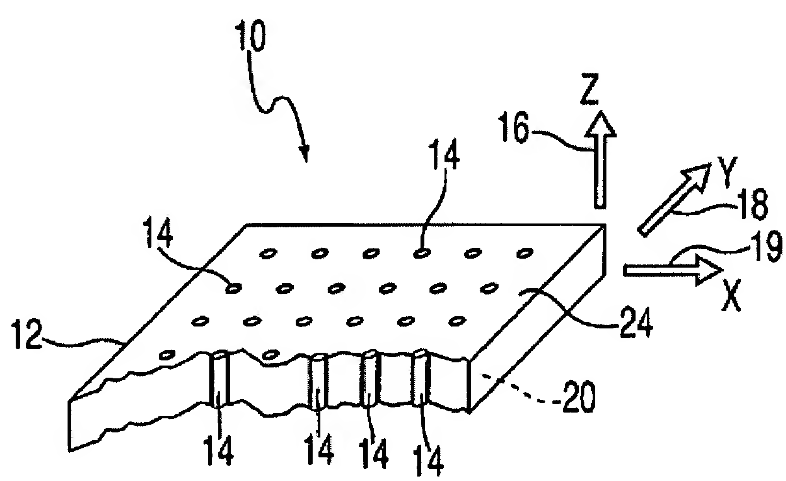
4. STATUS OF AMENDMENTS

There have been no amendments after the Final Office Action of December 16, 2003. The claims on Appeal are attached hereto as an Appendix.

5. SUMMARY OF THE INVENTION

The following is a concise explanation of the invention. Reference to the specification and drawings is made pursuant to 37 CFR 1.192 and is not intended to limit the claims to the embodiments shown and described in the application.

The invention relates to a thermal spreader that may be used in conjunction with a heat sink for cooling an electronic device. Figure 1, reproduced below, is representative of an embodiment of the invention.



Thermal spreader 10 is a conduction medium that provides for thermal communication between electronic circuitry (e.g., a chip) and an environment to which thermal spreader 10 is exposed. The thermal communication is effectuated by the conduction of heat across a substrate 12 to a heat sink. Because the materials from which substrate 12 are fabricated are generally of an anisotropic nature, substrate 12 is oftentimes characterized by a marked disparity in thermal conductivities in orthogonal directions. In particular, the thermal conductivity of substrate 12 in a direction shown by an arrow 16 (Z direction), which is normal to the interface of thermal spreader 10 and the circuitry (not shown), may be substantially less than thermal conductivities in the directions shown by an arrow 18 (Y direction) and an arrow 19 (X direction) along the same interface of thermal spreader 10 and the circuitry. Due to such disparities, the thermal resistance across substrate 12 (in the direction of arrow 16) is increased, and the rate of heat transfer (flux) across thermal spreader 10 varies dramatically from the flux in the direction (as shown by arrows 18 and 19) that the interface extends.

In order to enhance the thermal communication across thermal spreader 10, substrate 12 is configured to include thermal conduits 14. The materials from which thermal conduits 14 are fabricated generally have thermal conductivity values that are substantially higher than the thermal conductivity values in the Z direction of the material from which substrate 12 is fabricated. Because the flux through conduits 14 is greater than the flux in the same direction across the surrounding substrate 12, heat conduction is enhanced across substrate 12 in the direction shown by arrow 16 (Z direction), viz., in the direction in which conduits 14 extend. Heat transfer is thereby optimized through substrate 12 via conduits 14.

Conduits 14 are defined by rods or wires having substantially circular cross sectional geometries, as is shown. Rods or wires having substantially circular cross sectional geometries enable a substantially uniform transfer of heat to be maintained in the directions radial to the circular cross section. Other cross sectional geometries that may be used include, but are not limited to, elliptical, square, flat, multi-faced, and configurations incorporating combinations of the foregoing geometries. Regardless of the cross sectional geometry, conduits 14 are formed from materials having high thermal conductivities. Such materials include, but are not limited to, copper, aluminum, carbon,

carbon composites, and similar materials that exhibit a high thermal conductivity along the conduit axis. The carbon materials may be fibrous or particulate in structure.

6. ISSUES

Whether claims 1-6 are patentable over Gungor.

Whether claims 7-14 are patentable over Gungor in view of Eckblad.

7. GROUPING OF CLAIMS

With respect to the rejection based on Gungor alone, claims 1-6 stand or fall together.

With respect to the rejection based on Gungor in view of Eckblad, claims 7-14 stand or fall together.

8. ARGUMENT

Claims 1-6 were rejected under 35 U.S.C. § 102 or 103 as being unpatentable over Gungor. This rejection is traversed for the following reasons.

Claim 1 recites "a substrate having a first face and a second face, the second face being disposed parallel to the first face, the material of which said substrate is fabricated having anisotropic thermal conductivity with a first thermal conductivity value in a direction parallel to the faces and a second thermal conductivity value in a direction normal to the faces, the second thermal conductivity value being less than the first thermal conductivity value." As described in an exemplary embodiment shown in Appellants' Figure 1, the substrate 12 has higher thermal conductivity in the X and Y directions than in the Z direction. Thus, the conduits 14 improve the thermal conduction in the Z direction.

Gungor fails to teach or suggest a substrate having the anisotropic thermal conductivity recited in claim 1. Gungor discloses a heat spreader including a carrier 10 made up of a hybrid metal based composite substrate carrier consisting of an aluminum matrix reinforced with other materials (column 2, lines 60-65). Copper inserts 12 are embedded within the carrier 10. In applying Gungor, the Examiner construes the carrier

10 to correspond to the claimed substrate and the inserts 12 to correspond to the claimed conduits.

A key distinction between the claimed substrate and the carrier 10 of Gungor is the anisotropic thermal conductivity of the claimed substrate. It is important to note, that claim 1 defines the substrate alone as having the anisotropic thermal conductivity. As discussed below, the Examiner has inappropriately focused on the anisotropic thermal conductivity of the combined carrier 10 and inserts 12 of Gungor. Nowhere does Gungor teach or suggest that the carrier 10, by itself, has anisotropic thermal conductivity. In fact, such metal based substrates (e.g., aluminum or copper) typically have isotropic thermal conductivity. Appellants submitted arguments pointing out this distinction in response to the first Office Action.

In response to Appellants' arguments, the Examiner provides two grounds for why Gungor teaches the elements of claim 1. First, the Examiner asserts that "Gungor teaches the base composite substrate is carbon composite, which meets the present invention. It would be inherent to have the anisotropic thermal conductivity property as claimed by the applicant." See page 4 of Final Office Action, Examiner's response A. Appellants respectfully disagree. As noted in MPEP § 2112, inherency may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic <u>necessarily</u> flows from the teachings of the applied prior art.

The substrate in Gungor is a hybrid metal based composite which Appellants understand has isotropic thermal conductivity (column 2, lines 60-65). In fact, the preferred material for the substrate carrier 10 identified in column 3, lines 22-30 is an aluminum- silicon carbide matrix. Aluminum- silicon carbide materials in fact have isotropic thermal conductivity. Thus, Gungor does not teach the same substrate composition as described and claimed by Appellants. Accordingly, the anisotropic thermal conductivity is not inherent in the carrier of Gungor.

In the present case, the Examiner has provided no support for the reliance on inherency other than a broad statement that Gungor teaches a substrate carrier which

comprises the same ingredients and similar structure as the Appellants' invention. This reasoning is inappropriate as a mater of law and fact. Thus, the Examiner's reliance on inherency is improper.

Further, the Examiner states that there is no clear statement of thermal conductivities with the conduits embedded and that it is unclear whether the thermal conductivities between the first and second faces would change after the conduits were embedded. See page 4 of Final Office Action, Examiner's response B. Appellants submit that the thermal conductivities of the combined substrate and conduits are not recited in the claims, nor is such a recitation required. Gungor does not teach a substrate having the anisotropic thermal conductivity. It is not clear why the Examiner is questioning the thermal conductivity of the assembled heat spreader. This issue is simply not relevant to the claim language.

The Examiner also advances this reasoning on the paragraph bridging pages 2 and 3 of the Final Office Action. The Examiner reasons that the thermal conductivity in the vertical direction would be greater than the horizontal direction due to the copper inserts of Gungor. Again, claim 1 states that the substrate has the anisotropic thermal conductivity, not the combination of the substrate and the conduits. Thus, Gungor fails to teach or suggest the claimed substrate having anisotropic thermal conductivity.

For the above reasons, claim 1 is patentable over Gungor. Claims 2-6 variously depend from claim 1 and are patentable for at least the reasons advanced with respect to claim 1.

Claims 7-14 were rejected under 35 U.S.C. § 103 as being unpatentable over Gungor in view of Eckblad. Eckblad was relied upon for allegedly disclosing an adhesive and thermal paste. Claims 7-14 recite features similar to those in claim 1. Eckblad fails to cure the deficiencies of Gungor described above with reference to claim 1. Thus, claims 7-14 are patentable for at least the reasons advanced with respect to claim 1.

In view of the foregoing remarks, Appellants request reversal of the outstanding rejections.

If there are any charges due in connection with this response, please charge them to Deposit Account 09-0463 maintained by Appellants' Assignee.

Respectfully submitted,

By:____________________

David A. Fox
Registration No. 38,807
CANTOR COLBURN LLP
55 Griffin Road South
Bloomfield, CT 06002
Telephone (860) 286-2929
Facsimile (860) 286-0115
Customer No. 23413

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APPENDIX

1. A thermal spreading device disposable between electronic circuitry and a heat sink, the thermal spreading device comprising:

a substrate having a first face and a second face, the second face being disposed parallel to the first face, the material of which said substrate is fabricated having anisotropic thermal conductivity with a first thermal conductivity value in a direction parallel to the faces and a second thermal conductivity value in a direction normal to the faces, the second thermal conductivity value being less than the first thermal conductivity value; and

a plurality of conduits extending through said substrate from the first face thereof to the second face thereof, the material of which each conduit of said plurality of conduits is fabricated having a thermal conductivity value associated therewith, the thermal conductivity value of each conduit being greater than the second thermal conductivity value of said substrate.

2. The thermal spreading device of claim 1 wherein said substrate is fabricated from a material selected from the group consisting of carbon and carbon composite.

3. The thermal spreading device of claim 1 wherein each conduit of said plurality of conduits is defined by a rod having a substantially circular cross sectional geometry.

4. The thermal spreading device of claim 1 wherein each conduit of said plurality of conduits is positioned to be substantially equidistant from each other conduit of said plurality of conduits.

5. The thermal conduction medium of claim 1 wherein the density of said plurality of conduits is variable over an area of said substrate.

6. The thermal spreading device of claim 1 wherein each conduit of said plurality of conduits is fabricated from a material selected from the group consisting of copper, aluminum, carbon, and carbon composite.

7. A thermal conduction package for an arrangement of electronic circuitry, the thermal conduction package comprising:

an adhesive layer disposed on the electronic circuitry;

a substrate disposed on said adhesive layer, said substrate having anisotropic thermal conductivity with a first thermal conductivity value in a first direction parallel to said adhesive layer and a second thermal conductivity value in a second direction normal to said adhesive layer, the second thermal conductivity value of said substrate being less than the first thermal conductivity value of said substrate;

a thermal paste disposed on said substrate;

a plurality of thermally conductive conduits extending through said substrate from said adhesive layer to said thermal paste, each conduit of said plurality of conduits having a thermal conductivity value associated therewith, the thermal conductivity of each conduit being greater than the second thermal conductivity value of said substrate; and

a heat sink device disposed on said thermal paste.

8. The thermal conduction package of claim 7 wherein said adhesive layer is a material selected from the group consisting of solder and epoxy.

9. The thermal conduction package of claim 7 wherein each conduit of said plurality of conduits extends from a first face of said substrate in a linear direction to an opposingly positioned second face of said substrate.

10. The thermal conduction package of claim 7 wherein each conduit of said plurality of conduits is substantially equidistant from each other conduit of said plurality of conduits.

11. The thermal conduction package of claim 7 wherein the density of said plurality of conduits is variable over an area of said substrate, the density being greater proximate the electronic circuitry.

12. The thermal conduction package of claim 7 wherein each conduit of said plurality of conduits is fabricated from a material selected from the group consisting of copper, aluminum, carbon, and carbon composite.

13. The thermal conduction package of claim 7 wherein said substrate is fabricated from a carbon composite material.

14. The thermal conduction package of claim 7 wherein said thermal paste is a natural or synthetic oil-based compound with thermally conductive particle filler material.

IFW AF 3745

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TRANSMITTAL OF APPEAL BRIEF (Large Entity)

Docket No. POU920010084US1

In Re Application Of: RICHARD C. CHU ET AL

Serial No.	Filing Date	Examiner	Group Art Unit
09/965,489	September 27, 2001	Lam	3745

Invention: **THERMAL SPREADER USING THERMAL CONDUITS**

TO THE COMMISSIONER FOR PATENTS:

Transmitted herewith in triplicate is the Appeal Brief in this application, with respect to the Notice of Appeal filed on **April 15, 2004.**

The fee for filing this Appeal Brief is: **$330.00**

☐ A check in the amount of the fee is enclosed.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **09-0463**

Signature

Dated: **June 10, 2004**

David A. Fox
Registration No. 38,807
CANTOR COLBURN LLP
55 Griffin Road South
Bloomfield, CT 06002
Telephone (860) 286-2929
Facsimile (860) 286-0115

Customer No. 23413

cc:

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Sheila Smedick

Typed or Printed Name of Person Mailing Correspondence